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for the Behavioral and Social Sciences**

Research Report 1712

Audio Teletraining for Unit Clerks: A Cost-Effectiveness Analysis

Robert A. Wisher
U.S. Army Research Institute

Annette N. Priest
George Mason University

Edward C. Glover
Professional Education Center

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U.S. ARMY RESEARCH INSTITUTE FOR THE BEHAVIORAL AND SOCIAL SCIENCES

**A Field Operating Agency Under the Jurisdiction
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**EDGAR M. JOHNSON
Director**

Technical review by

Hyder Lakhani
Ruth H. Phelps

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14. ABSTRACT (<i>Maximum 200 words</i>): A cost-effectiveness analysis of training Army National Guard soldiers by audio teletraining technology was conducted. The trainees were n=225 soldiers nationwide. About half of the trainees received training in a 3-week Unit Clerk Course through traditional residence training at the Professional Education Center in Little Rock, AR. The remainder received the same instruction by the same instructors through audio teletraining, a low-cost training technology. Objective performance data were collected from written tests on 16 of the 47 tasks taught. Trainees in the audio teletraining group had a 93% Go rate (on first attempt), which was significantly higher (by statistical test) than the 85% Go rate for the residence group. In comparing costs, the audio teletraining group had lower training costs, on average \$1,135 per trainee. This was due primarily to an avoidance of travel costs for the audio teletraining group. Projected on an annual basis, the Army National Guard can save \$292,404 per year through the use of audio teletraining for the Unit Clerk Course.					
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			21. RESPONSIBLE PERSON (Name and Telephone Number) Robert A. Wisher (703) 617-5540		

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Audio Teletraining for Unit Clerks: A Cost-Effectiveness Analysis

Robert A. Wisher

U.S. Army Research Institute

Annette N. Priest

George Mason University

Edward C. Glover

Professional Education Center

**Advanced Training Methods Research Unit
Robert J. Seidel, Chief**

U.S. Army Research Institute for the Behavioral and Social Sciences
5001 Eisenhower Avenue, Alexandria, Virginia 22333-5600

Office, Deputy Chief of Staff for Personnel
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FOREWORD

The U.S. Army Research Institute for the Behavioral and Social Sciences, through a Memorandum of Agreement with the National Guard Bureau (NGB) and the Army National Guard (ARNG), provides technical support to NGB initiative on distance learning technologies. One form of this support is the evaluation of the training effectiveness and costs of alternate forms of instructional delivery.

The present report demonstrates that, in certain cases, low-cost alternatives to classroom instruction, namely audio teletraining, can achieve remarkable cost savings while maintaining a high quality of instruction. Although there are many military tasks for which audio teletraining would be inappropriate, such as any task with a hands-on component, it could serve well for routine, knowledge-based tasks that emphasize print media. Such is the case for the tasks trained to unit clerks in the ARNG through the Professional Education Center, Camp Robinson, AR. The present report provides a cost-effectiveness analysis of audio teletraining for the Unit Clerk Course. Its results should be factored in to considerations of the mix of training technologies appropriate for cost-effective distance learning delivery.

ZITA M. SIMUTIS
Technical Director

EDGAR M. JOHNSON
Director

AUDIO TELETRAINING FOR UNIT CLERKS: A COST-EFFECTIVENESS ANALYSIS

EXECUTIVE SUMMARY

Research Requirement:

In 1995 the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) signed a Memorandum of Agreement with the National Guard Bureau to serve as the program manager for the academic component of the Army National Guard (ARNG) distance learning network. As set forth in that agreement, ARI agreed to conduct evaluations of various distance learning alternatives. This particular research examines the cost effectiveness of using audio training originating from an instructional site at the Professional Education Center, Camp Robinson, AR, to various remote sites situated at ARNG facilities across the country.

Procedure:

The participants were $n=225$ soldiers from ARNG units nationwide. Of these, $n=118$ participated in the audio teletraining version of the 3-week Unit Clerk Course and $n=107$ participated in the same course in residence at Camp Robinson, AR. Objective performance data were collected from written tests on 16 of the 47 tasks taught. Cost data were computed for material distribution, audio bridge, equipment, travel, and test monitors.

Findings:

Students in the audio teletraining group had a 93% Go rate (on first attempt) for the 16 performance tests, which was significantly higher (by statistical measures) than the 85% Go rate for the residence group. In comparing costs, the audio teletraining group had lower training costs, on average \$1,135 per student. This was due primarily to an avoidance of travel costs for the audio teletraining group. Projected on the annual training load, the ARNG can save \$292,404 per year through the use of audio teletraining for the Unit Clerk Course.

Utilization of Findings:

This research demonstrates the cost-effectiveness of audio teletraining for selected courses. The ARNG and the Deputy Chief of Staff, Training for the Training and Doctrine Command have been briefed on these results. Audio teletraining is one tool available for distance learning. Army trainers should consider the merits of training through a low-cost, audio-only mode when the tasks and materials are appropriate.

AUDIO TELETRAINING FOR UNIT CLERKS: A COST-EFFECTIVENESS ANALYSIS

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AUDIO TELETRAINING FOR UNIT CLERKS: A COST-EFFECTIVENESS ANALYSIS

Introduction

The Army National Guard (ARNG) has the challenge to maintain a well-trained and ready force during a period of declining training resources. One option to meet this challenge is the application of distance learning technologies as a training method. Of course, the quality of training must remain high and the costs must be acceptable in order for this option to be feasible. The purpose of this report is to document an effort by the ARNG to apply a low cost, distance learning tool, audio teletraining, to train geographically dispersed soldiers. Specifically, an analysis of the training effectiveness and costs between groups trained either in residence or through audio teletraining for the Unit Clerk Course will be presented. This distance learning example should be useful as the ARNG examines cost factors for future training requirements.

Distance learning is not new to the Army. Indeed, the Training and Doctrine Command (TRADOC) is advocating widespread use of distance learning in the near future (TRADOC, 1996) and the ARNG has responded by developing a plan to connect classrooms in 54 States and Territories as one distance learning network (National Guard Bureau, 1996). In the education and training literature, distance learning has various definitions. It is generally regarded as learning that occurs in a different place from the teacher (Moore and Kearsley, 1996). Educational television is a classic example. Radio training serves as an even earlier example (Woelfel and Tyler, 1945). The advent of satellite and terrestrial networks as well as the widespread use of personal computers and the Internet has catapulted distance learning into the forefront of educational change. Indeed, universities, state and federal agencies, trade organizations, and industry now offer distance learning format for thousands of courses. A motivating factor for this change is cost. In many cases, it is cheaper to have the students remain where they are and "project" the teacher to distant classrooms.

The least expensive form of such “projection” of instruction is an audio link between sites. Audio teletraining, the focus of the present report, is simply a high-quality conference call that allows people at multiple locations to hear and speak to one another over ordinary telephone lines. It is audio conferencing with the goal of training. In the research literature on distance learning, audio teletraining has received much less attention than various forms of video-based training, such as CD-ROM, video conferencing, or emerging multimedia technologies. The reason is due, in part, to the obvious lack of a visual medium that an instructor can display, mark, manipulate, and control in instructionally useful ways. Other advantages to video are that it allows students to “travel” to new places or observe demonstrations that are otherwise costly or dangerous to demonstrate. In cases where training depends on a visual presentation, particularly one that is animated or needs to be controlled by the instructor, audio teletraining alone would be unsatisfactory. Such a visual requirement is not always the case.

Another reason why audio teletraining has received little attention is that there has been an inclination in distance learning to replicate the classroom setting of face-to-face delivery, regardless of content. Here students observe both the instructor and the material being presented and, in the case of two-way video, instructors can observe the students and what they might present. Some researchers have observed that the inclination to the face-to-face video format derives from the fact that traditional instruction is the only familiar instructional frame of reference for designers, developers, and decision makers on these matters. Furthermore, there is the perception that students prefer the security of having their instructor in close proximity, in a real or virtual sense (Hardy and Olcott, 1995). These issues are more organizational than instructional. Nevertheless, audio teletraining might be well suited for instruction in which static visual information can be provided to students in advance and for a course in which the instruction is sequential with little branching. Such is the case for training unit clerks in the ARNG.

A description of the Unit Clerk Course will be presented along with the data collection methods, the analytical approach, and the results concerning the cost

effectiveness of audio teletraining for the Unit Clerk Course. The discussion section will include an overview of distance learning, a review of the research literature on the effectiveness of audio teletraining, and an accounting of the results in the present study.

Method

Unit Clerk Course

In an ARNG unit, the unit clerk is responsible for recording, updating, and maintaining personnel records of unit members, from company level through higher echelons. These records relate to a broad range of topics, such as finance, life insurance, personnel qualification records, statements of medical examination, unit manning reports, and discharge certification. Altogether, forty-seven tasks are trained. The rank of a typical student is sergeant with a military occupational specialty (MOS) of 71L Unit Administrative Specialist, although soldiers in paygrade E-4 through E-7 and from other MOS can participate. In the past fiscal year (FY96), 280 ARNG soldiers were trained as unit clerks.

Until recently, training for the unit clerk was conducted entirely at the Professional Education Center (PEC) located in Camp Robinson, in North Little Rock, Arkansas. The three week course required that soldiers travel to Camp Robinson, be billeted and provided meals. A distance learning initiative at PEC afforded the opportunity to convert the course to a distance learning format.

Participants

Participants were n=225 soldiers serving as trainees from ARNG units nationwide. Of these, n=107 participated in the resident classroom version of the Unit Clerk Course, and n=118 participated in the audio teletraining version. Assignment to groups was based on which month the soldier was scheduled for training, so that all soldiers trained in November 1995, December 1995, and May 1996 were trained in the resident classroom whereas soldiers trained in March 1996 and August 1996 were trained

through audio teletraining. (Note: This sample does not represent every student who took the Unit Clerk Course in FY96.)

Program of Instruction and Instructors

The same program of instruction, student workbooks, job aids, and tests were used by both groups. The same four instructors taught the course to each group. Each student workbook and job aid were uniquely color coded, which allowed for easy reference in the audio teletraining format, e.g., "refer to your green job aid."

Testing

Written performance tests were administered for 16 of the 47 tasks taught. The 16 tasks that were tested were:

1. Prepare DA Form 1379, Completing a Training Certificate, Unit Record Of Reserve Training
2. Compute/Verify Pay Entry Basic Date
3. Compute/Verify Retirement Year
4. Prepare DA Form 4836: Oath of Extension or Reenlistment
5. Determine qualification for Promotion and award of MOS using Promotion Eligibility Checklist
6. Prepare DD Form 93: Record of Emergency Data
7. Prepare DA Form 2-1: Personnel Qualification Record
8. Prepare DA Form 2-1: Compute/verify Date of Rank
9. Prepare NGB Form 22 Report of Separation and Record of Service 55 Series Discharge Certificate
10. Prepare DD Form 1883 Survivor Benefit Plan Election Certificate
11. Coordinate medical care for injured/ill soldier
12. Determine/ Prepare/ Review/ Process Incapacitation Pay

13. Prepare DA Form 2173: Statement of Medical Examination and Duty Status, Prepare/Review Line of Duty Investigation, Sworn Statement
14. Prepare DA Form 2823 (Sworn Witness Statement)
15. Review and screen NCO-Evaluation Report for errors
16. Maintain (MARKS) Modern Army Record Keeping System

Data Collection

Data collection occurred after training was completed. Enrollment records, diagnostic data, performance test scores and cost data were obtained for all students from the ARNG Professional Education Center for students who recently participated in either the audio teletraining or resident instructional format. No additional tests or questionnaires specific to this study were given to the students. Instructors for the Unit Clerk Course were interviewed for additional information on preparation of materials, conduct of the training, and insights into the nature of interactions in the distance learning format.

Results

The comparative effectiveness of the two forms of training will first be presented, followed by a description of relevant cost factors. This will be followed by an overall cost-effectiveness analysis between the audio teletraining and resident modes of instructional delivery.

Training Effectiveness

The analysis of training effectiveness must first take into account any differences between groups. Perhaps the largest single factor that could potentially bias the results was prior knowledge about the course content. Since some of the soldiers had familiarity with the responsibilities of a unit's clerical tasks, due to the fact that many already had a primary military occupational specialty in the clerical field, their performance on the diagnostic test for unit clerks was a key in comparing prior knowledge between groups. The diagnostic test administered to all soldiers at the beginning of the course found a 9.2% Go rate for the audio teletraining group and a 10.6% Go rate for the residence classroom group ($t=.87$, not significant). Thus, with respect to prior knowledge, there was no difference between groups. Any differences between the treatment groups (audio teletraining or residence) could not be attributed to differences between members of the groups.

In order to determine if performance on the tasks measured immediately after training, and hence training effectiveness, was different between the two groups, a multivariate analysis of variance (MANOVA) was performed (Tabachnick and Fidell, 1989). The performance variables for those soldiers who received a Go on the diagnostic test were recoded as also getting a Go on the first attempt after training. This was done in order to preserve a reasonable sample size. Otherwise, soldiers who received a Go on as little as one diagnostic (but took the first test on the remaining 15 task variables) would be dropped entirely from the analysis due to missing data¹. The assumption here is that if a soldier received a Go on a diagnostic test, he or she would also have received a Go on the test after some additional training, which seems reasonable. Table 1 displays the performance on the diagnostic test, the test given immediately after the first round of training and the graduation rate.

¹ Because the percentage of subjects getting a Go on the diagnostic was not significantly different between the two groups (9.2% vs. 10.6%) as described above, we did not anticipate that the inclusion of these few data points would alter the effects of the MANOVA. Furthermore, the analytical alternative of dropping all of the data for these subjects would have meant that the MANOVA would be restricted to scores of only those individuals who did not receive Go scores on any of the diagnostic measures, which did not seem representative of our sample.

Table 1

Performance Data between Groups

	Group	
	<u>Audio Teletraining</u>	<u>Residence</u>
	(n=118)	(n=107)
Diagnostic Test	9.2% Go	10.6% Go
First test after training	93.3% Go	85.4% Go
Graduation Rate	100%	100%

For the multivariate analysis, which tests whether there was a statistically significant difference between groups on the first test after training, the sixteen task variables were entered as the dependent variables (measured as a Go or No Go score, 1 or 0), and group membership (Audio Teletraining or Residence) was entered as the independent variable. As MANOVA combines the dependent variables into a linear combination, which represents task performance, it was clear that there was a statistically significant difference between groups on task performance ($F(15, 196) = 4.80, p < .001$).

There was superior learning performance exhibited by the audio teletraining group, as measured by first time Go rate. However, there was equivalence in the graduation rate between groups, since all students ultimately passed the course. Thus, although students learned more quickly in the distance learning format, in a course of fixed length (3 weeks) where there was ample time for retraining and retesting, there was equal effectiveness between groups. This analysis supports many previous reports that a distance learning group performed as well as, if not better than, a resident control group.

Cost Analysis

In comparing costs between two training delivery methods, one must first identify which cost elements are stable and which elements differ. The differences must then be quantified, added and compared. In the present analysis, the differences were computed

on a per capita basis and then projected on an annual basis, based on training loads provided by the Professional Education Center. All costs reported are in Fiscal Year 1996 dollars.

Stable cost elements. The following cost elements were assumed to be identical between the two treatment groups.

1. Salary for students. The average student in the unit clerk course was at the E-5 paygrade. Although there might have been a slight difference in the average step within that paygrade between the two samples, the small difference was considered arbitrary.
2. Instructors. Since the same four instructors taught each course, this cost element was stable. That is, the cost for the same instructors to teach either a three-week resident course or three-week distance learning course was identical.
3. Course materials. The costs for preparation and production of books, worksheets, job aids, and tests was the same for either group.

Differing cost elements. The following cost elements varied between groups.

1. Distribution of materials. There was a \$5.00 charge per student for overnight delivery of course materials in the audio teletraining group. Those in the residence group received the materials in the classroom at the beginning of the course.
2. Audio bridge. There was a \$.04 per minute per site charge for connection to the audio bridge. For a five and one-half hour instructional day, this translates to \$13.20 per day per site (\$.04 per minute multiplied by 330 minutes). For 15 days of instruction, this multiplies to \$198 per site. Based on recent class iterations, there were ten sites per class accommodating an average of 59 students per class, so this computes to an average of \$33.56 per student per class ([\$198 per site multiplied by 10 sites] divided by [59 students]).
3. Travel. For students in the resident classroom group, the average travel cost was: airfare \$700, lodging \$342 (18 days at \$19 per day), and meals \$92.87 (18.5 days at \$5.02 per day), for a total of \$1,134.87. For students in the audio teletraining group, the average travel cost for the three weeks of training was \$18. (Note: Most of these students traveled to their local armories or were within reasonable commuting distance of an

armory where instruction was offered. In these cases, there was no travel charges. A few students had mileage or overnight lodging charges. The \$18 average for a class of 59 students was based on a compilation of data from a recent iteration in which one student required lodging and several required mileage.)

4. Equipment. The audio teletraining classroom required a high quality audio conferencing system, which cost \$500 per site. This conferencing system can have many uses beyond audio teletraining for the armory and its units. Hence, an assumed effective capital expenditure of \$250 per site was made, allowing for 50% usage for other purposes such as conference calls to state headquarters. Also, an assumption of a 5-year life with no salvage cost was made. A final assumption was that each site would conduct three audio teletraining classes per year, comparable in size to the Unit Clerk Course. These assumptions translate into a cost of \$2.82 per student ($[\$250 \text{ per site divided by } 5 \text{ years}] \text{ divided by } [3 \text{ iterations per year multiplied by } 5.9 \text{ students per iteration}]$).

5. Test monitor. Each remote site required the duties of a test monitor to perform an audio check prior to the start of the course, take roll call on the first day of instruction, and serve as a test control officer on three occasions during the course. The latter function requires the administration, scoring and reporting of individual student scores to the origination site at the Professional Education Center. Total time required for the test monitor function was 14 hours. Typically, a soldier at paygrade E-7 served as the test monitor, although paygrades E-6 and E-8 have also been employed. The total time for the test monitor at each site was 14 hours. Additionally, there was a \$5.00 cost for providing tests and answer keys to each test monitor. The cost for this function was \$184 per site. Computed on a per student basis (5.9 students per site) this cost element was \$31.19.

Table 2

Cost elements differing between groups on per student basis

	<u>Audio teletraining</u>	<u>Residence</u>
Distribution of materials	+ \$5.00	
Audio bridge	+ \$33.56	
Travel	+ \$18.00	+ \$1,134.87
Equipment	+ \$2.82	
Test monitor	+ 31.19	
Total	\$90.57	\$1,134.87
Difference		\$1,044.30

Cost avoidance. The cost element data are presented in Table 2. A computation of cost avoidance was derived on a per capita basis on the cost elements identified above. This figure was then multiplied by the training load for a full training year. For students in the audio teletraining class, there were unique costs of \$90.57 per capita (for distribution, audio bridging, audio conferencing system, and mileage). For students in residence, there were unique costs of \$1,134.87 per capita (for travel). The net savings per student, then, is \$1,044.30. Multiplied across the annual training load of 280 students, the overall cost avoidance is \$292,404 per year.

Discussion

In a recent study on the use of technology for training and education in the Army, the Army Science Board recommended that the Army "continue to develop and acquire modern classroom technology, but emphasize a move toward distance learning" (Grum, et al., 1995, p.37). The results of the present study lend further support to this position: the Army National Guard Unit Clerk Course can be taught as effectively through distance learning at a substantially lower cost. After a general review of distance learning in the military, the discussion will explore the findings of the present study in more detail and

offer recommendations of when to use audio teletraining as a training tool.

Distance Learning

U.S. Military training has employed distance learning in various forms. For example, the Chief of Naval Education and Training (CNET) now has videoteletraining (VTT) in operational use through the CNET Electronic Schoolhouse Network. This VTT system uses an interactive two-way video and audio television system that allows students at remote sites to participate in training from an origination site where other students are located with the instructor. Research on the effectiveness of the CNET Electronic Schoolhouse Network has demonstrated equal effectiveness between resident classroom and remote site (Simpson, Wetzel & Pugh, 1995, Wetzel, 1995, Wetzel, Radtke, Parchman & Seymour, 1996). The Air Force has a similar VTT system, and NATO countries have also been using distance learning in various forms successfully (Seidel and Chatelier, 1994). An evaluation of service plans for using distance learning technologies to train Reserve Component personnel reported that distance learning has the potential to provide effective training and reduce costs (Metzko, Redding & Fletcher, 1996).

Studies of distance learning in the Army have demonstrated similar results. For example, the application of the distance learning tool of asynchronous computer conferencing for the Engineering Officer Advance Course showed no difference between resident and distance learning students on objective measures of performance, but the distance learning course cost less than the resident version (Phelps, Wells, Ashworth & Hahn, 1991). In an example with soldiers from the Reserve Component (RC), the application of two-way interactive video for training three military occupational specialties to RC soldiers demonstrated performance as high as soldiers trained in a resident mode (Bramble and Martin, 1995). In another study that examined the training effectiveness of one-way and two-way video, Lehman and Kinney (1992) report that one-way VTT performed better than two-way VTT for a course on common leader training to noncommissioned officers from the RC. In support of distance learning, the Army has

maintained distance learning facilities for several years, featuring a two-way interactive system known as the Teletraining Network, or TNET (Schall, 1991).

On a broader level, distance learning is viewed by the Army as the “delivery of standardized individual, collective, and self-development training to soldiers and units at the right place and right time through the application of multiple means and technology” (TRADOC, 1996). Because of the numerous training technologies this definition implies, it is useful to regard distance learning from a toolbox point of view. That is, there are different instructional tools that can be selected and applied to satisfy a training requirement. The choice of tool depends on the type of task being taught, the purpose of the training, the size of the training audience, the cost, and the availability of facilities, equipment, and courseware. Such a toolbox allows for multiple media to be used in appropriate combinations for a course. The variety of tools available for the ARNG distance learning network permits considerations of training effectiveness and costs as factors in deciding on which media functions to use.

Instructional Issues

One interesting facet of audio teletraining is the autonomy that balances across the instructional sites. Each student is known to the instructors solely on the basis of test performance and how well they respond to spoken questions. Since students cannot know whether they will be the next to be called upon to answer a question, there is a perception on the part of the instructors that students in the audio teletraining mode attend to the instruction more carefully than their resident mode counterparts. Furthermore, the accuracy of responses reflects on both the student and his remote-site “peer group,” each of whom is a member of that state’s Army National Guard. A cohesion between students at a remote site might form that is not unlike the cohesion that forms within platoons of a line company.

Research on cohesion within small units of the Army has demonstrated that the higher the cohesion, the higher the motivation to perform well (Siebold and Kelly, 1988).

If it is the case that the cohesion, and thus motivation, of the students at the remote site was greater than that of the resident students, the higher performance on first test after training (93% versus 85%) could be attributed to a higher level of motivation at the remote sites. Since students in the residence course are not segregated into small groups, the condition for small unit cohesion to form is not as likely to occur.

Another instructional consideration in the present study concerns the use of different learning strategies. Previous research has demonstrated that students are not conscious of the newly adapted learning strategies they use to acquire skills and knowledge in the unconventional, distance learning classrooms (Eastmond, 1995). The need to stay in close step to the instruction, since any student may be called upon next, may have led to development of an attentive learning strategy that improved knowledge acquisition as reflected in the higher first time Go rates in Table 1.

Cost Effectiveness

The cost effectiveness of technology-based training in the military has been previously documented (Orlansky and String, 1979, Wisher and O'Hara, 1981, Fletcher, 1990). Generally, technology-based training leads to improved skill and knowledge acquisition rates. In the present study, although there was no difference in the overall, final pass rate between the two groups, the audio teletraining group performed better than the residence group on the performance test administered immediately after training. This finding is consistent with many previous findings on the effectiveness of technology-based training. Of greater importance here, however, is the fact that the audio teletraining format costs much less than the residence format. Based on the cost and performance factors analyzed in the present report, the audio teletraining format is clearly cost effective.

Other cost advantages. Not quantified in the results section are other benefits that can accrue from a distance learning format. The first is in productivity during training. The course was five and one-half hours per day. For students in the distance learning

format, this would allow another two and one-half hours of productive work time for the student at home unit. Of course, for those who had a short commute or used the time to study this would not necessarily be the case, but it is a notable advantage. A second benefit is avoiding travel to training sites, which, in addition to saving money, avoids the need for family support and other away-from-home considerations for the individual soldier. With reserve component soldiers being required increasingly to deploy on missions such as Operation Joint Endeavor, Operation Restore Hope, and the Multinational Force and Observers in the Sinai, less time away from home for training can reduce the overall time away from family and community.

Conclusions and Recommendations

Audio is a critical component of nearly all distance learning technologies. In the face-to-face instruction that occurs through videoteletraining, for instance, low ratings of the quality of the audio can quickly overshadow the quality of an otherwise excellent video production². Ineffective instruction can result. The importance of high quality audio for facilitating distance learning instruction has been identified repeatedly in the literature (Garrison, 1990, Hardy and Olcott, 1995). Modern audio conferencing technologies, procured at a low cost and capable of transmitting over highly reliable telephone lines, offers quality audio for instructional purposes. Its cost effectiveness has been demonstrated in the present study and in other training and education applications (Burge and Howard, 1990).

The use of audio teletraining to deliver the Unit Clerk Course is a cost effective means to provide this training to soldiers on a nationwide basis. The estimated cost savings on an annual basis is about \$292,000. The audio teletraining course should be scheduled so that as many unit's as is feasible have the opportunity to participate in this training.

The audio teletraining format has potential for cost savings for other training applications. Courses that are candidates for conversion to audio teletraining are those

² In an analysis of single-day training events conducted for the ARNG over the past year, quality of audio was rated lower than quality of video and there was a statistically significant correlation between quality of

that involve print based media that could be sent in advance to students. The candidate courses should also be highly structured, knowledge-based (rather than hands-on skills) and have periodic paper-and-pencil tests. To realize a considerable cost savings, the course should eliminate the need to travel from an armory to a centralized training site.

Finally, the fact that distance learning has again demonstrated equal or superior instructional effectiveness to traditional classroom training should no longer be surprising, as its effectiveness has been demonstrated hundreds of times (Russell, 1996). Other factors that are inherent to a distance learning format, such as a higher level of motivation and the adoption of a new learning strategy by individual students, could also have contributed to the superior learning performance of the students in the audio teletraining group. The strongest finding in the present study, however, is the substantial cost savings that resulted from a perfect fit between a routine course and low-cost technology.

There is a continuing need to research and evaluate the most cost-effective means to deliver distance learning. From the present study, the “low-end” technology of print and audio teletraining was well suited to the training requirement for unit clerks. In view of the range of training tools available through distance learning – print, videotape, computer-based training, CD-ROM, video teletraining, audio teletraining, and the Internet – there needs to be an ongoing effort to understand the best match between task, training tool and cost.

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